“Supply Chain Efficiency through Vendor Selection Mechanism: A study on Risk Mitigation & Cost Optimization in Indian Power Sector”

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This thesis presents a bright and analytical study of vendor selection as a key supply chain problem within the Indian power industry. Situated at the juncture of informatics, research, and dynamic modelling, this study intends to create a procurement infrastructure that is resilient to shocks, cost-efficient, and sustainable amidst uncertainties of a volatile business environment. Based on a multi-theoretic base corroborated with practical validation, it moves away from polemics on vendors as mere cost centres and places vendor selection as a strategic capability to improve operational agility and competitive strength.

The dissertation goes on to discuss in detail the conceptual framework, research methodology, empirical analyses, and optimization models that form the backbone of this inquiry. Each chapter exposes a different interrelated dimension of the investigation: the conceptual ground of VSM; bibliometric mapping of intellectual trends; empirical validation exploiting the PLS-SEM approach; and the evolution of a myriad of dynamic optimization models tailored to the power industry. Together, these chapters articulate the evolution of ideas, methodological rigor, and interpretive insights driving this research.

Embedding institutional examples, policy perspectives, and contextual analyses will further imbue the thesis with a sophisticated understanding of how vendor selection can be converted to strategic means for resilience and sustainability. The chapter-wise organization follows a modular logic and a narrative continuity entrapping the intellectual architecture of the study: theorization on a conceptual level, confirmation through empirical findings, and practical applications. As the ultimate goal of the study, it stands as an intellectual contribution and practical blueprint for how a robust, evidentially supported, and dynamically adaptive vendor selection methodology can transform procurement strategy in India's power sector and beyond.

The major highlights of the chapters pertaining to the study is thus duly given below:

Chapter 1: Introduction

Chapter 1 lays the foundation for the study. It emphasizes the strategic importance of supply chain efficiency and vendor selection in the Indian power sector, a domain typified by high capital intensity and regulations, with exposures to risks such as cost overruns, project delays, and global supply dependencies. It explains the transition of Vendor Selection Mechanism (VSM) from a traditional, cost-driven procurement practice to a strategic capability that determines resilience, innovation, sustainability, and digital transformation.

This chapter reviews literature in a critical manner to illustrate the static nature of existing vendor selection models, their fragmentation, and the preoccupation of the models with the lowest-bid selection. The models find a limited place for risk management, technology readiness, and ESG (Environment-Social-Governance) factors. This marks these limitations as research gaps on which grounds an Indian power-sector-specific multi-theoretic, holistic, and empirically validated framework is warranted.

Response-wise, the chapter defines the objectives, research questions, and scope of this study: thus, from this very definition, a clear road map is set forth for conceptualization, theoretical grounding, bibliometric mapping, empirical validation, and optimization modelling, with the chapter concluding by discussing the theoretical, managerial, and policy significance of the research-the vendor selection being a critical lever for cost optimization and risk mitigation towards a sustainable energy transition, also aligned with national interest such as Atmanirbhar Bharat selections.

Chapter 2: Theoretical Frameworks

This chapter serves to furnish the working-theoretical construct and conceptual framework, establishing a very rich multidimensional perspective that collectively views the Vendor Selection Mechanism (VSM) in the Indian power sector. Concepts ranging from Transaction Cost Economics (TCE), Resource-Based View (RBV), Agency Theory, Risk Management Theory, Systems Theory, and Multi-Criteria Decision-Making (MCDM) are infused in the chapter to suggest that vendor selection includes risk mitigation, technological readiness, resilience, and strategic capacity-building, as opposed to mere cost minimization.

Each theory provides its own shade and perspective - TCE would focus on the mechanism of transaction efficiency and governance; RBV would consider resources and capabilities for strategic ends; Agency would view information asymmetry alignment and incentives; Risk would look at uncertainty mitigations; Systems would see supply chains as interdependent adaptive systems, and MCDM would give analytical tools for dealing with multiple and often conflicting criteria set by vendors.

The chapter attempts to unify these theoretical frameworks into an all-encompassing conceptual model showing the major constructs: vendor reputation and compliance, procurement efficiency, relationship management, risk mitigation, and cost optimization. Furthermore, technological readiness is proposed as a moderating variable that boosts vendor strategies' effectiveness in a digitally competitive environment.

Chapter 2 basically placed vendor selection as a value-creating system rather than just an operational choice. This situates global theoretical insights within the regulatory and infrastructural realities of India, thus intellectually preparing the backdrop for subsequent bibliometric mapping in Chapter 3 and empirical validation using PLS-SEM in Chapter 4.

Chapter 3: Bibliometric and Systematic Literature Analysis

This chapter of the study presents a comprehensive bibliometric analysis containing the intellectual evolution of vendor selection and supply chain research from 2005 to 2025, thereby grounding the study with a strong empirical and scholarly context. Employing Scopus-indexed literature as the data bank, the chapter uses bibliometric mapping and visualization tools to identify key publication patterns, authors, and journals; geographical contributions; and thematic clusters that define the field.

Thus, according to the analysis, four separate phases exist within the evolutionary phase of research: cost focus (2005-2010), risk and sustainability (2011-2015), digitalization and resilience (2016-2020), and then ESG integration, technology adoption, and global supply chain robustness (2021-2025). According to the co-occurrence and co-citation analysis, the emerging alliance of sustainability, technology readiness, and risk mitigation is now at the central stage driving science.

This chapter systematically mapped with the highlights of research hotspots and intellectual frontiers also identified the critical gaps, especially those concerning the absent multi-theoretic, dynamic vendor selection model, which is sector-specific for the Indian power sector. These insights empirically bridge the trend in literature with the theoretical framework, thereby providing the basis for hypothesis formulation and validation of the model in the next chapter.

Chapter 4: Empirical Validation via PLS-SEM

The fourth chapter is the empirical nucleus of the research, giving shape to the conceptual underpinnings of the VSM with statistically verifiable insights. It tests and verifies the causal relationships among the major constructs of vendor credibility, procurement efficiency, relationship management, risk mitigation, and cost optimization concerning the Indian power sector.

Partial Least Squares Structural Equation Modelling (PLS-SEM) is used to analyse the hypothesized paths with data from procurement professionals across public and private power utilities in India. The measurement models are assessed for reliability and validity, followed

by structural model testing to analyse the strength and the significance of relationships among latent variables.

The results suggest that vendor selection influences risk mitigation, cost efficiency, and operational performance, with relationship management and procurement efficiency mediating this effect to build a long-term resilient supply chain. The readiness for technology has also been identified as a major moderating factor that further strengthens the relationship between VSM practices and organizational performance outcomes amid digital transformation.

Researchers concluded the chapter by explaining that the proposed multi-theoretical framework can be empirically tested and validated, when later showing how this integrated VSM can be a strategic enabler of agility, sustainability, and competitiveness in the power sector. These findings serve as an analysing base for the coming optimization modelling and managerial implications to be discussed in Chapter 5.

Chapter 5: A Dynamic Vendor Selection Model

Chapter 5 advances the study from empirical validation to optimization and decision enhancement, focusing on improving the VSM using quantitative modelling and computational approach. While the previous chapter validated well from the theory and statistics perspective, now this chapter demonstrates how it can be optimized for practical application in the Indian power sector that assures cost efficiency, risk mitigation, and operational resilience.

In this chapter, we present mathematical optimization techniques, especially linear programming and goal programming approaches, to build models that select the best vendor combinations according to real-world constraints on budgets, qualities, timely deliveries, and sustainability standards. These decision models based on the multi-criteria decision-making (MCDM) logic take conflicting objectives for procurement sectors- economic performances into account aligning strategic resilience.

While comparing the pre- and post-optimization results unveils the improvements with enormous gains in procurement cost efficiency, vendor reliability, and risk-adjusted performance, these findings portrayed how an integrated optimization framework based on the validated VSM could aid as a strategic decision-support tool for power utilities faced with the complexities in a volatile supply ecosystem.

At last, Chapter 5 bridges the gap between empirical validation and inference optimization, providing a quantitative design for policymakers and procurement officers to improve vendor management along Atmanirbhar Bharat and energy resilience lines.

Chapter 6: Discussion and Implications

Chapter 6 brings together empirical insights, optimization results, and theoretical arguments so that a joint synthesis of the findings and their implications can be delivered. The chapter places the validated VSM in the broader context of supply chain resilience and sustainable procurement in the Indian power sector. It demonstrates how vendor selection has grown from being a mere cost consideration to an entire strategic capability that balances risk mitigation, cost reduction, digital readiness, and relational capital.

This chapter demonstrates multi-theoretic consistency of the proposed model by integrating findings provided by both PLS-SEM analyses (Chapter 4) and optimization modelling (Chapter 5) with their conceptual and bibliometric underpinnings (Chapters 2 and 3), which renders the proposed model consistent with the RBV, DCV, TOE, and Systems Theory. The considerations thereby show that vendor maturity, agility, innovation, and contracting efficiency constitute pillars for procurement resilience whereas digital readiness acts as a strategic moderator for the enhancement of long-term performance.

The chapter then contributes to the advancement of the existing theory by gaining insights from the dynamic model, thus providing concepts of the processual evolution of resources, resource decay, and continued renewal of capacities. Managerially, the chapter provides practical advice to help power utilities use VSM to establish the right balance between cost efficiency and risk control, embed technological transformation into procurement, and rejuvenate vendors along with human capital.

That is to say, Chapter 6 essentially serves as an interface between theory and practice. It highlights how the selection of vendors considering digital agility and sustainability could introduce an entirely new procurement philosophy, far from its customary transactional one aimed at enabling competitiveness, resilience, and value creation over time in the power sector.

Chapter 7: Summary, Findings, Limitations, and Future Directions

Chapter 7 approaches the finalization of the study by interweaving the theoretical, empirical, and optimization insights gained throughout the research effort. It reiterates the primary aim of the present study, i.e., the development and validation of an integrated, multi-theoretic Vendor

Selection Mechanism (VSM) specific to the Indian power sector, thereby judging the degree to which this framework is able to address the research gaps identified in the preceding chapters. The chapter goes on to emphasize that vendor selection, in strategic and dynamic viewpoints, becomes a core competence in building supply chain resilience, cost minimization, and sustainable performance in a VUCA environment.

The findings reaffirm that the union of theoretical perspectives (TCE, RBV, DCV, ROT, TOE, and SET), backed by empirical validation in terms of PLS-SEM applicability and optimization modelling, offers a complete prism for viewing procurement efficiency. The chapter distills key managerial and policy-based implications to nail down how aspects of digital readiness, innovation, and sustainability can transform vendor management in the power ecosystem of India.

Acknowledging its limitations, the study brings contextual issues such as sectoral focus, sample representativeness, and the temporal dimension of issues, exposing potential horizons for the framework to be extended to cross-sectoral and cross-country analyses, incorporating both dynamic simulation and AI-driven predictive models, in addition to probing the behavioural and governance aspects of vendor collaboration.

With the final chapter, the study is brought to closure, providing both the development of theory as well as a guide for practitioners, wherein the VSM emerges as a metamorphic mechanism tying together theory, data, and decision intelligence to create conditional procurement systems in India that are more resilient, sustainable, and autonomous, amid changes in the energy sector.

In a nutshell, this study finally sees the Vendor Selection Mechanism (VSM) as a transformative strategic architecture that fosters procurement resilience and sustainability while furthering India's march toward energy self-reliance under the umbrella of Atmanirbhar Bharat. The framework thus put forth in the thesis, emerging from theory, data, and decision intelligence, attempts an integrated, empirical, and future-ready approach to reimaging vendor selection as a vehicle through which the Indian power sector can compete on the world stage.

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